

Prognosis of morbidity on type 2 diabetes according to the FINDRISC questionnaire — preliminary study

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Abstract

Introduction. Diabetes is not only an issue related to secretory organs or complications permanently attached to any ongoing disease process, but it is also an issue of public health as it is one of the four top priority non-contagious diseases the entire world is fighting against.

The aim of this research was to assess the risk of possible diabetes incidence amongst a group of test subjects which may occur in the next decade. The study was based on a FINDRISC questionnaire.

Material and methods. The research group were comprised of 100 responders at the ages of 18 to 88, including 70 female and 30 male subjects. The mean age of the men was 47.6 ± 19.98 years, while for the women it was 53.61 ± 18.31 years.

Results. The results obtained in the questionnaire showed that the risk of diabetes incidence increased in subjects who turned 55 years of age in comparison to the younger responders. The risk of developing diabetes increased with the increase of BMI at the correlation coefficient 0.657 and $p < 0.001$.

Conclusions. Genetic affinity was determined to be an irrelevant variable in the risk of developing diabetes. Both BMI and the age were strong factors determining the future risk of diabetes incidence.

Key words: diabetes, FINDRISC questionnaire, obesity, metabolic disease

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Introduction

Diabetes is a disease comprised of many metabolic diseases, one of the main ones being hyperglycemia, a chronic condition resulting from disorders in producing insulin and/or the body being resistant to the effect of insulin [1].

Type 2 diabetes is most commonly observed in adults and results from insulin secretion and limited tissue sensitivity to insulin. The pathogenesis of this disease is a complex issue and a background to many

diabetes-related hypotheses based on genetic factors, environmental influence and damage of β -beta cells on the islets of Langerhans in the pancreas. Additionally, correlations between other factors such as age, BMI, lack of physical activity, nutritional errors and obesity determine the group of people with an increased risk of suffering from diabetes [2, 3].

The symptoms of diabetes may occur early but may not be associated with the disease itself. They are: weight loss, general fatigue, decrease in attention or skin infections. The common symptoms of diabetes are:

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increased appetite, thirst, frequent urination, glucose in urine, problems with vision, dry skin and mucous membranes leading to difficulty in healing foot ulcers [3].

Although diabetes is not an infectious disease, the United Nations declared it to be an epidemic of the 21st century. In 2013, the International Diabetes Federation recorded approximately 382 million people suffering from diabetes all over the world and 3 million of them were Poles. Nearly one million people do not realize they are ill. It is estimated that by 2035 there will be around 600 million people suffering from diabetes in the world. The number of diabetics is steadily increasing. It is especially observable in developing countries, and is related to bad lifestyle, which leads to obesity, hypertension and lipid disorders [4].

According to Topór-Mądry [5] in 2015 there were 2.73 million people suffering from diabetes in Poland. But only 2.15 million were aware of that fact. At the same time as many as 550 did not know about it. Over 90% of diagnosed cases of type 2 diabetes result from obesity and an aging society [5].

The worst part of diabetes is not the disease but its complications. World statistics show that 15 million people are reported to lose their vision due to retinopathy. In Poland there are 3.5 diabetics who need dialysis. A diabetic foot is amputated in 50% of said patients. Incidence rates for lower-extremity amputations among diabetics are 12.5 to 31.6 times higher in comparison to non-diabetics. People suffering from diabetes are subject to amputations of lower extremities twice as often as healthy people [6].

Half of these patients suffer from coronary disease, 66% of whom die due to cardiovascular complications. In general, 30,000 people have died in Poland as a result of diabetes [7, 8].

This research aimed to evaluate the probability of diabetes incidence in healthy subjects in the next decade based on age, BMI, taking medication for hypertension and having a family member suffering from type 2 diabetes.

Material and methods

The research was conducted on a group of 100 subjects at the ages of 18 to 88 years. None of them were diagnosed with diabetes type 1 and 2. The research group was comprised of 70 female and 30 male subjects. The mean age of the men was 47.6 ± 19.98 years, while for the women it was 53.61 ± 18.31 years. BMI and waist circumference values were increased or high in over 50% of the tested subjects. The participants were patients of PROVITA Specialized Centre for Prevention and Treatment in Wrocław. Patients from the analyzed

Table 1. Characteristics of the studied group

Variable	Number of responses (n)	Responses (%)
Gender		
Female	70	70%
Male	30	30%
Age (years)		
Female	53.61 ± 18.31	
Male	47.6 ± 19.98	
Education		
Elementary	10	10%
Vocational	21	21%
Secondary	40	40%
Higher	29	29%
BMI		
< 25 kg/m ²	23 ± 4.6	39%
25–30 kg/m ²	26.4 ± 8.2	42%
> 30 kg/m ²	31.6 ± 6.3	19%
Waist circumference		
Women		
< 80 cm	17	17%
80–88 cm	25	25%
> 88 cm	28	28%
Men		
< 90 cm	8	8%
94–102 cm	10	10%
> 102 cm	12	12%

group participated in rehabilitation treatments due to motor organ diseases (Table 1).

The research was based on the standardized Finish Diabetes Risk Score (FINDRISC) questionnaire and our own survey. The FINDRISC questionnaire was developed by the Finish Diabetes Association. FINDRISC is a simple and clear tool comprised of 8 questions. Each answer is granted a certain number of points, which summed up indicate the risk of having type 2 diabetes in the next decade. The higher the score the greater the risk of diabetes incidence.

First three questions refer to anthropometric data such as age, body mass index and waist circumference. The next two questions ask about lifestyle, physical activity and diet.

The last three questions are related to taking hypertension medication, incorrect blood glucose level and having a family member suffering from type 2 diabetes.

Table 2. Risk of suffering from diabetes based on the FINDRISC questionnaire and studied age groups

Risk of diabetes incidence / Age range	Low	Slightly increased	Moderate	High	Very high
< 45 years N = 35 (35%)	N = 28 (28%)	N = 6 (6%)	N = 1 (1%)		
45–54 years N = 11 (11%)	N = 5 (5%)	N = 6 (6%)			
55–64 years N = 25 (25%)	N = 5 (5%)	N = 9 (9%)	N = 4 (4%)	N = 5 (5%)	N = 2 (2%)
> 65 years N = 29 (29%)	N = 2 (2%)	N = 9 (9%)	N = 10 (10%)	N = 6 (6%)	N = 2 (2%)

Table 3. Risk of type 2 diabetes in reference to BMI values

Risk of diabetes incidence	Low	Slightly increased	Moderate	High	Very high
< 25 kg/m ²	N = 27	N = 10	N = 2	N = 0	N = 0
25–30 kg/m ²	N = 12	N = 13	N = 9	N = 5	N = 3
> 30 kg/m ²	N = 1	N = 7	N = 3	N = 7	N = 1

The higher the score the greater the risk of diabetes. The risk is lowest in people whose score is lower than 7 points. The risk of having type 2 diabetes by such a person in the next ten years is very low and equals to 1 incidence per 100 subjects. The patients whose values range between 7 and 11 points are in a group with a slightly increased risk of diabetes. The range of 12–14 points covers subjects with a moderate risk of having type 2 diabetes. The responders with a score of 15–20 points are in a high risk group where 1 out of 3 subjects develop diabetes within 10 years. The group with the highest risk of type 2 diabetes is that with a score exceeding 20 points. A patient with such score has a 50% chance of suffering from type 2 diabetes within 10 years [10].

The survey prepared by the researchers was designed to collect sociodemographic data such as subjects' gender, age, BMI, education.

The research was approved by the Commission of Bioethics at Wrocław Medical University (Ref. KB-130/2015) and the consent of each patient to participate in the questionnaire was given.

The results obtained were statistically analyzed by R 3.2.1 software with its source code published for the license GNU GPL. Correlations between the variables were tested by Spearman's rank correlation coefficient, the chi-square test, the ANOVA test and the Monte-Carlo method. Statistical significance was observed for $p < 0.0001$.

Results

The results of the FINDRISC questionnaire showed that 40% of the studied subjects displayed low probability of developing type 2 diabetes within the next 10 years, in 30% of patients the risk was slightly increased, 14% had a moderate risk, while 12% showed high and 4% very high risk of diabetes.

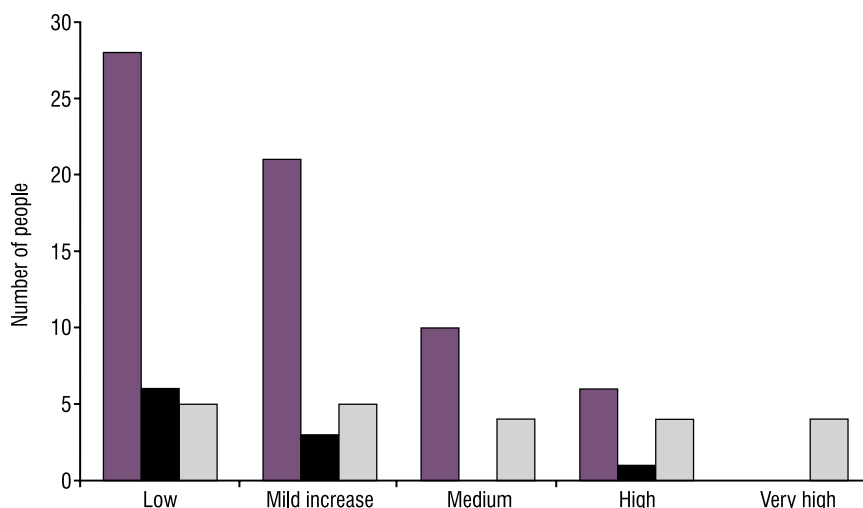
The highest percentage of subjects at the lowest risk of type 2 diabetes was characteristic of patients under the age of 45. There were no subjects in this group displaying a high risk. In subjects between 45–54 there was a visible increase in the likelihood of having a diabetes and the observed values were similar to those obtained by the group with increased risk. The next two age groups: 55–64 and over 64 revealed a further increase in comparison with the younger age groups. The values attained by these subjects were at moderate, high or even very high levels, which pointed to a high risk of developing type 2 diabetes within 10 years (Table 2).

The analysis of direction and correlation level between the questionnaires and BMI values established the correlation coefficient at 0.657 for $p < 0.001$. Hence, it can be concluded that there is a statistically significant, positive correlation between BMI and the incidence of type 2 diabetes (Table 3).

Spearman's rank correlation coefficient computed for the total result of the questionnaire and physical

Table 4. Relationship between taking hypertension medication and incidence of diabetes

Taking hypertension medications/Risk of diabetes incidence	Low	Slightly increased	Moderate	High	Very high
No	N = 37	N = 19	N = 5	N = 2	N = 0
Yes	N = 3	N = 11	N = 9	N = 10	N = 4

**Figure 1.** The relationship between having a family member with diabetes and risk of developing type 2 diabetes (p-values = 0.015)

effort reported by the responders was “rho” = -0.259 for $p < 0.010$. The minus indicates that the risk of incidence is inversely proportional to physical activity, i.e. it is lower in physically active people. In this fashion, the researchers showed the positive impact of physical activity on the decreased risk of developing type 2 diabetes. Another variable which could have influenced the results of a questionnaire were hypertension medication taken by the subjects (Table 4).

The chi-square test was introduced to examine differences in the development of type 2 diabetes between the subjects who took hypertension medications and those who did not. The values indicated the existence of a correlation between taking hypertension medication and the incidence of diabetes ($\chi^2 = 37.269$, for $p = 0.001$). 37 of the 100 subjects took hypertension medications such as: ACE inhibitors, beta blockers and calcium antagonists. Hypertension was leveled off. They did not report any other comorbidities related to the development of diabetes.

Additionally, the researchers studied differences in the risk of diabetes incidence based on the waist circumference of men and women separately and without such division. The analysis conducted did not reveal any significant correlations between the gender values ($p = 0.739$) and waist circumference ($p = 0.706$), but waist

circumference was statistically significant for $p < 0.001$. It was observed that an increase in waist circumferences increased the risk of diabetes incidence.

The studied direction and influence of the medication on the risk of developing diabetes enabled the determination of the correlation coefficient at 0.639 for $p < 0.001$. The results obtained showed a strong correlation between taking hypertension medication and the incidence of diabetes, revealing an increased risk of diabetes.

The results also showed an increased risk of developing type 2 diabetes in people who have a family member with diabetes ($p = 0.015$). In case of the person being a close relative, the risk was very high and high for less than 10 studied subjects, and moderate or slightly increased for 10 subjects. If it is a distant relative who suffers from the disease, then the risk is limited only to individual cases (Figure 1).

Discussion

Statistics showing the number of people suffering from type 2 diabetes are appalling and keep increasing, something which is confirmed by information from the International Diabetes Federation presented in this study. The data shows that in 1980 there were 153

million people suffering from type 2 diabetes. Less than three decades was enough for this number to double. The estimates show that in 2030 there will be over half a billion people suffering from type 2 diabetes [3].

A similar situation can be observed in Poland. In 2011 every tenth adult (3.1 million) of the population suffered from type 2 diabetes. As much as 1 million people from that number were not aware of their condition. The result is a lack of treatment, followed by complications. If diabetes prevention and education were introduced early enough, it would enable the identification of people with an increased risk of developing type 2 diabetes as well as early detection of the disease to prevent and stop its development, or at least decrease the risk of complications.

Our research has shown that the FINDRISC questionnaire is a desirable tool to detect the risk of type 2 diabetes. Its great advantage is its simple structure which facilitates the quick detection of people with an increased risk of the disease. Moreover, the tool provides 85% accuracy [14].

The research conducted with the use of FINDRISC scale showed that age was a strong determinant of developing type 2 diabetes. The highest risk of diabetes incidence was observed in subjects between 55–64 and over 64. Similar results were obtained by Cisińska et al. [11]. Partial data on the epidemic of type 2 diabetes suggest that age is a key factor of its incidence. This is confirmed by NATPOL studies which have proven that up to 25% of people over 60 suffer from diabetes [15].

Another analyzed criterion was body mass index. It strongly correlated with the development risk of type 2 diabetes. A study carried out on a Finish population showed that 5% decrease in body mass decreases the risk of type 2 diabetes by nearly 70% [15, 16]. The authors of this research have also observed such dependency on BMI values and their positive correlation with the FINDRISC results.

The analysis conducted revealed that non-physically active subjects were at two times higher risk of developing diabetes than those who did some sports activities. However, the influence on the total risk score of the questionnaire was small. Similar results were attained in subjects studied at the University Teaching Hospital in Lodz [17].

Adamiec et al. [18] in their study conducted on Wrocław residents observed a positive correlation between hypertension and the risk for type 2 diabetes. More than 50% of the studied subjects suffered from hypertension. The situation was comparable in the case of the research carried out in Poland on patients with hypertension. That study showed high or very high risk of type 2 diabetes in over 40% of the studied subjects. Analysis of the Screen-Pol test pointed out

that hyperglycemia was the highest risk factor of type 2 diabetes [16].

Our research indicated that the risk of type 2 diabetes was fivefold higher in people taking hypertension medicaments than in those who had never been treated for high blood pressure.

According to Sieradzki et al. [15] genetic predisposition increases the risk of type 2 diabetes, however, it needs to be combined with the negative influence of external factors. Our research confirmed that positive family history increases the risk of type 2 diabetes. A family with a diabetic member is the factor having the greatest influence on the total risk score. Even though the results were not appalling and the high and very high risk of type 2 diabetes in the studied groups was respectively 12% and 4%, it should be emphasized that the studied population was not numerous and changes in said values may differ in accordance to the number of responders. As reported by POZ-NAD, the group with high and very high probability of developing type 2 diabetes comprised 29.6% of the test subjects [17].

Diabetes is a global issue that particularly threatens developing countries. Its development is mainly related to unhealthy lifestyle, obesity and an aging society. The greatest increase in the number of cases is expected in the upcoming years in Asia and Africa related to changes in eating habits. The number of diabetes cases and their complications will cause an increase in the cost of treatment, hospitalization and rehabilitation and will directly burden government finances. According to the International Diabetes Federation, the costs associated with treatment of diabetes in 2012 in the world were USD 471 billion. In Poland, the National Health Fund spent over PLN 5.6 billion, half of which was on treating diabetes complications. Many experts claim that dramatically increasing cost of treating diabetes will force governments to introduce programs aiming to limit diabetes incidence and improve early detection. The FINDRISC questionnaire may turn out to be the right and easy tool needed to evaluate the risk of this disease in the Polish population [11, 12, 18].

Conclusions

1. The results attained on the basis of the FINDRISC questionnaire have proven the existence of a strong correlation between type 2 diabetes in subjects over 55 years of age.
2. High BIM values and taking hypertension medication by the tested subjects confirmed risk of type 2 diabetes.
3. A family member suffering from diabetes was a variable having an insignificant influence on the FINDRISC questionnaire results.

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